

Homework 10 (due Apr 29)

1. A quadrupole magnet is used to correct betatron tunes in a circular accelerator. It is placed in a region where the amplitude function is $\beta = 40$ m. Calculate by how much the quadrupole's focusing power $1/f$ has to change to produce a tune shift $\Delta\nu = 0.015$.
2. Consider the following measurements on 900-GeV protons in the Tevatron, where the transition energy is $\gamma_t = 18$. The resonant cavities normally operate at 53 MHz nominal value. Their frequency is increased by 245 Hz, and the horizontal tune measurement yields $\nu_x = 20.418$. When the frequency is brought 245 Hz below the nominal value, the tune is 20.432.
 - (a) What is the fractional momentum difference ($\Delta p/p$) between the two measurements?
 - (b) If the dispersion function at a particular location is 4 m, what beam displacement do you expect to observe there during these measurements?
 - (c) What is the chromaticity of the machine? Is it positive or negative?